Title

PISTON

DESCRIPTION

Technical Field

The invention relates to a piston made of a dimensionally stable material and externally, on its outer periphery, enclosed by a sealing ring.

PRIOR ART

Such pistons are generally known, for example from DE 195 13 727 A1. The piston can be moved back and forth parallel to its axis in a cylindrical housing, it contains a carrier part made of a hard material and a guide ring which externally at least partly encloses the carrier part, said guide ring consisting of a polymeric material and being provided with sealing lips which under initial elastic tension touch the inner wall of the housing facing the piston. The carrier part and the guide ring are interlinked when pressed or locked together, the carrier part being provided with at least one open groove extending on the peripheral side radially in the direction of the guide ring, said groove being interlinked with at least one fabricated projection protruding radially in the direction of the carrier part. The guide ring has axially on both sides fabricated one-piece sealing lips extending in radial direction over the contact surface of the carrier part. The pressing force with which

the sealing lips touch the surface of the housing where the sealing is to occur is relatively high even when the pressure in the space to be sealed off is relatively low.

PRESENTATION OF THE INVENTION

The object of the of the invention is to further develop the piston of the aforesaid kind in a manner such that the friction of the piston within the housing, particularly when low pressures are to be contained, is reduced. Moreover, it was to be possible to fabricate the piston in simple and economic fashion and to confer to it good use properties over a long service life.

According to the invention, this objective is reached through the features of Claim 1. Advantageous embodiments of the invention are covered by the subclaims.

To reach said objective, a piston made of a dimensionally stable material is surrounded on its outer periphery with a sealing ring made of an outward inflatable elastically yielding material. By means of the inflatable sealing ring, the pressing force with which the sealing ring touches the surface of the piston-surrounding housing for sealing purposes is adapted to the conditions of the application in question and is varied to render the pressing force proportional to the pressure to be contained.

At very low pressure, the sealing ring is not at all, or is only very slightly, inflated, and the

surface of the piston-surrounding housing is touched for sealing purposes with only very low pressing force. As a result of the low pressing force exerted by the sealing lip against the sealing surface, the piston is very sensitively moved back and forth in the housing. The slight pressing force reliably prevents stick-slip effects.

For example, if the sealing pressure within the housing increases, the sealing ring is inflated further thus touching with increased pressing force the housing surface at which the sealing is to occur.

The friction between the inflatable sealing ring and the sealing surface is also proportional to the pressure to be contained.

The sealing ring is preferably made from a polymeric material and more preferably from a PTFE compound [PTFE = polytetrafluoroethylene - Translator]. The friction between the sealing ring and the sealing surface is thus further reduced. Moreover, such a piston constantly exhibits good use properties during its very long service life, because the sealing ring, after a negligible initial wear, vitrifies thus becoming highly resistant.

The piston can be provided with a jacket in the form of a hollow cylinder which, for purposes of inflating the sealing ring, is provided with at least one recess connecting a pressurizable working space with the internal peripheral surface of the sealing ring. The pressure prevailing in the working space also acts on the internal peripheral surface of the sealing ring. For example, if the pressure in the working space increases, this increased

pressure also acts on the inner surface of the sealing ring inflating it radially outward in the direction of the sealing surface. The sealing ring seals automatically by pressing against the sealing surface with variable force.

On the other hand, if the pressure within the working space is reduced, the pressure applied to the internal peripheral surface of the sealing ring is also reduced, and the comparatively lower pressure is contained by a comparatively lower force pressing the sealing ring against the sealing surface.

The working space is limited by a housing that surrounds the piston on its outer peripheral side. The piston can be used, for example, as a shock absorber in automotive vehicles.

The inflatable region can be created, for example, by a convex bulge of the sealing ring directed radially outward when viewed along the longitudinal section of the piston, or by providing the sealing ring in its inflatable region with at least one outwardly springy sealing lip capable of touching the sealing surface of the housing so as to bring about the sealing.

The advantage of the convex outward bulging region is that such a piston exhibits particularly good sealing properties when it is disposed slightly eccentrically relative to the housing. Moreover, such a piston can be produced in simple and economic fashion.

On the other hand, if the sealing ring is provided with a sealing lip that can elastically

expand outward, it is advantageous that, even at low pressures within the working space, sealing against the housing is activated.

In this case, the sealing lip can have the form of a hinged film and is created by making a cut into the sealing lip material without removing any material.

The automatic inflation of the sealing ring occurs exclusively as a function of pressure in the working space. Said ring does not require separate activation devices.

The medium for inflating the sealing ring can be hydraulic or pneumatic depending on which medium is present within the working space. The inflatable region can be located frontally on one side of the sealing ring. Such an arrangement is advantageous for many applications.

In the case that only the inflatable region of the sealing ring can press against the sealing surface of the housing, it is advantageous that, as a result of this spatially limited range, the friction between the sealing ring and the sealing surface of the housing is reduced to a minimum.

For another application, particularly when the piston can be moved back and forth in the axial direction, and when it is intended to seal in both directions and is used, for example, in a shock absorber of a motor vehicle, it is advantageous if the inflatable region is located frontally on one side of the sealing ring, a sealing lip being provided frontally on

the other side. In such a case, sealing in one direction is then brought about by the inflatable region, and in the other direction by the sealing lip. This arrangement is particularly advantageous for use in shock absorbers of motor vehicles, because reliable sealing is provided even under extreme conditions, for example when a lateral force acts on the piston and/or said piston, because of other reasons related to fabrication and/or assembly, is disposed eccentrically within the housing. During operation of the piston, the sealing lip is then effective in only one direction.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following Figures 1 and 2, two embodiments of the piston of the invention are described in greater detail. Each of these drawings is a schematic representation of a detail of the piston of the invention.

Fig. 1 shows a first embodiment wherein, when pressure is applied, the sealing ring inflates radially in the direction of the sealing surface.

Fig. 2 shows a second embodiment wherein the sealing ring encloses a sealing lip capable of elastically expanding in the direction of the sealing surface.

Figs. 1 and 2 show a piston similar to that of DE 196 13 727 A1. Sealing ring 1 of the piston of the invention can, as here depicted, be provided with inflatable region 7 frontally

on one side and with sealing lip 10 frontally on the other side. Sealing ring 1 is designed as a bandage enclosing the piston and has an axial extension closely corresponding to the extension of the piston. On the sides facing each other, the piston and sealing ring 1 have congruent profiles that bring about a force-actuated connection and/or interlocking of the parts. In another embodiment, sealing lip 10 is absent, and only inflatable region 7 of sealing ring 1 can touch sealing surface 8 of housing 6 to bring about sealing.

In the non-pressurized state, sealing surface 8 of housing 6, which is shown only schematically, is disposed at a small radial distance from sealing ring 1, or sealing ring 1 touches housing 8 at only very slight preliminary radial tension. When low pressures prevail within working space 4, the contact pressure of sealing ring 1 against sealing surface 8 is only minor. With increasing pressure in working space 4, on the other hand, this pressure propagates through recess 3 within jacket 2 of the piston as far as the inner peripheral surface 5 of sealing ring 1 and inflates inflatable region 7 of sealing ring 1 in the direction of sealing surface 8 of housing 6 in a manner such that inflatable region 7 touches sealing surface 8 at a higher preliminary radial tension.

When the pressure in working space 4 is reduced, the inflation in inflatable region 7 again decreases as a result of the elasticity of the material constituting sealing ring 1.

In Figs. 1 and 2, sealing ring 1 is represented by broken lines. The automatic inflation of sealing ring 1 occurs exclusively as a function of the pressure in working space 4.

Fig. 1 depicts a first embodiment of the piston of the invention wherein sealing ring 1, viewed in the longitudinal direction of the piston, has a tubular shape and is linked to the surface of the piston. With increasing pressure in working space 4, inflatable region 7 inflates outward in a convex, radial manner thus touching sealing surface 8 of housing 6 in sealing fashion.

Fig. 2 shows a second embodiment that differs from the embodiment of Fig. 1 in that inflatable region 7 is formed by sealing lip 9 which, when the pressure within working space 4 increases, swings radially outward in the direction of sealing surface 8 of housing 6 thus touching sealing surface 8 in a sealing manner. Sealing lip 9 is in the form of a hinged film.